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N400 amplitudes as Bayesian surprise at the level of meaning

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Abstract

In the study of human language comprehension, the N400 brain potential is often used as an index of on-line processing of meaning. However, a more precise account of its underlying computational process is still debated. Previous neural network modelling work simulated N400 amplitudes as change in a probabilistic representation corresponding to an internal implicit prediction error or Bayesian surprise at the level of meaning (Rabovsky, Hansen, & McClelland, 2018). Here we further test this account using a Bayesian learner model to simulate semantic processing of nouns from different semantic categories presented in an oddball like roving paradigm. We show that Bayesian surprise at the level of meaning significantly predicts N400 amplitudes and does so to a significantly higher degree than a non-Bayesian baseline. This sets the N400 in relation to ERP mismatch negativities in perceptual oddball paradigms, which have featured prominently in Bayesian accounts of brain function.